K-IB-02.13/4

APOLLO/SATURN IB
FLIGHT SAFETY PLAN
VEHICLE AS-204/LM1

December 15, 1967

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SECTION II
FLIGHT SAFETY RESPONSIBILITIES

2.1 AIR FORCE EASTERN TEST RANGE

The Webb-McNamara agreement of January 17, 1963, supplemented by the AFMTC/LOC agreements of June 5, 1963, places the responsibility for flight safety of all launches from the AFETR on the AFETR commander. This responsibility includes specifying flight termination system requirements; protecting life and property from an errant vehicle (except within KSC); establishing data requirements, impact limit lines, flight safety instrumentation requirements, etc.

2.2 KENNEDY SPACE CENTER

The Director, KSC, by the same agreements cited in paragraph 2.1, is responsible for the protection of life and property within KSC from an errant vehicle launched or intended to be launched from Cape Kennedy or KSC. This responsibility includes designating launch danger areas within KSC, clearing these areas during danger periods, etc. Also included is the responsibility for crew safety on manned launches from KSC. This responsibility does not include Range Safety flight termination control of the vehicle after lift-off, which is the sole responsibility of the AFETR commander. To that extent, the protection of life and property within KSC is a joint effort of KSC and AFETR.

SECTION III
FLIGHT SAFETY REQUIREMENTS

3-1 FLIGHT TERMINATION SYSTEMS

All ballistic or space booster vehicles launched at the AFETR must contain two independent flight termination systems that are compatible with the AFETR ground system. The two systems must be installed on the last powered stage and must be capable of destroying all powered stages of the vehicles. A command system is not required for stages that go into orbit prior to ignition. However, the stage must be capable of being destroyed by command from the preceding stage and also must contain an automatic flight termination system. All stages that do not contain a command system must contain an automatic flight termination system. The automatic flight termination system destroys the thrust capability of the stage in the event of premature separation or breakoff from the other stages carrying a flight termination system. The termination system is automatically activated by mechanical means when premature separation or breakoff occurs. The manned portion of a space vehicle will not require a destruct system on manned flights. Propulsive systems that are not considered a stage of a vehicle (retrorockets, escape rockets, payloads, etc.) and that present radiological, toxicological, or explosive hazards will require an automatic flight termination system if they have the capability of violating the launch area or flight safety lines. For liquid-propelled vehicles, flight termination action must cause engine shutdown and fuel dispersion or intermixing, depending upon the nature of the propellants.

The Apollo/Saturn IB carries two independent flight termination and propellant dispersion systems in each active booster stage. There is no destruct system associated with the Lunar Module (LM1). Figures 3-1 and 3-2 pictorially display the IB flight termination/propellant dispersion system.

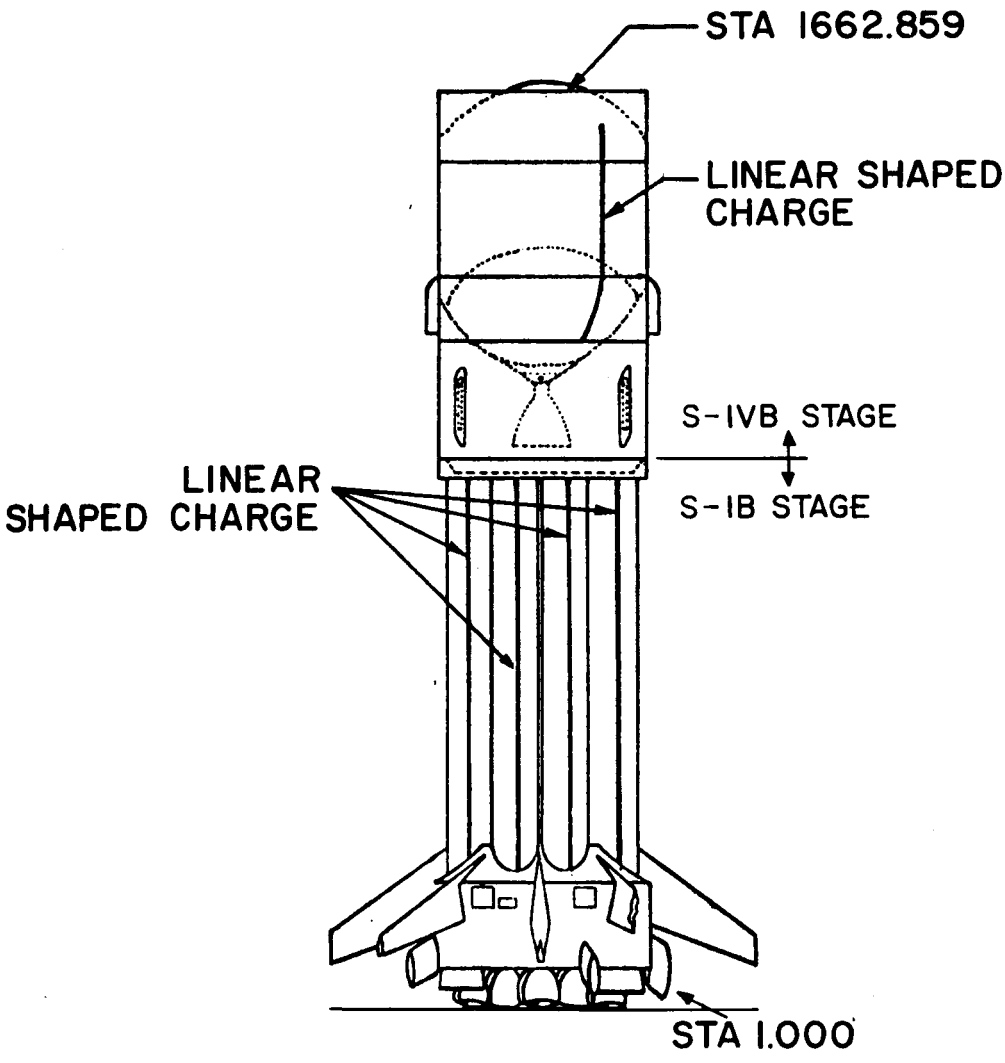

Figure 3-1. Propellant Dispersion Ordnance - Shaped Charge Locations

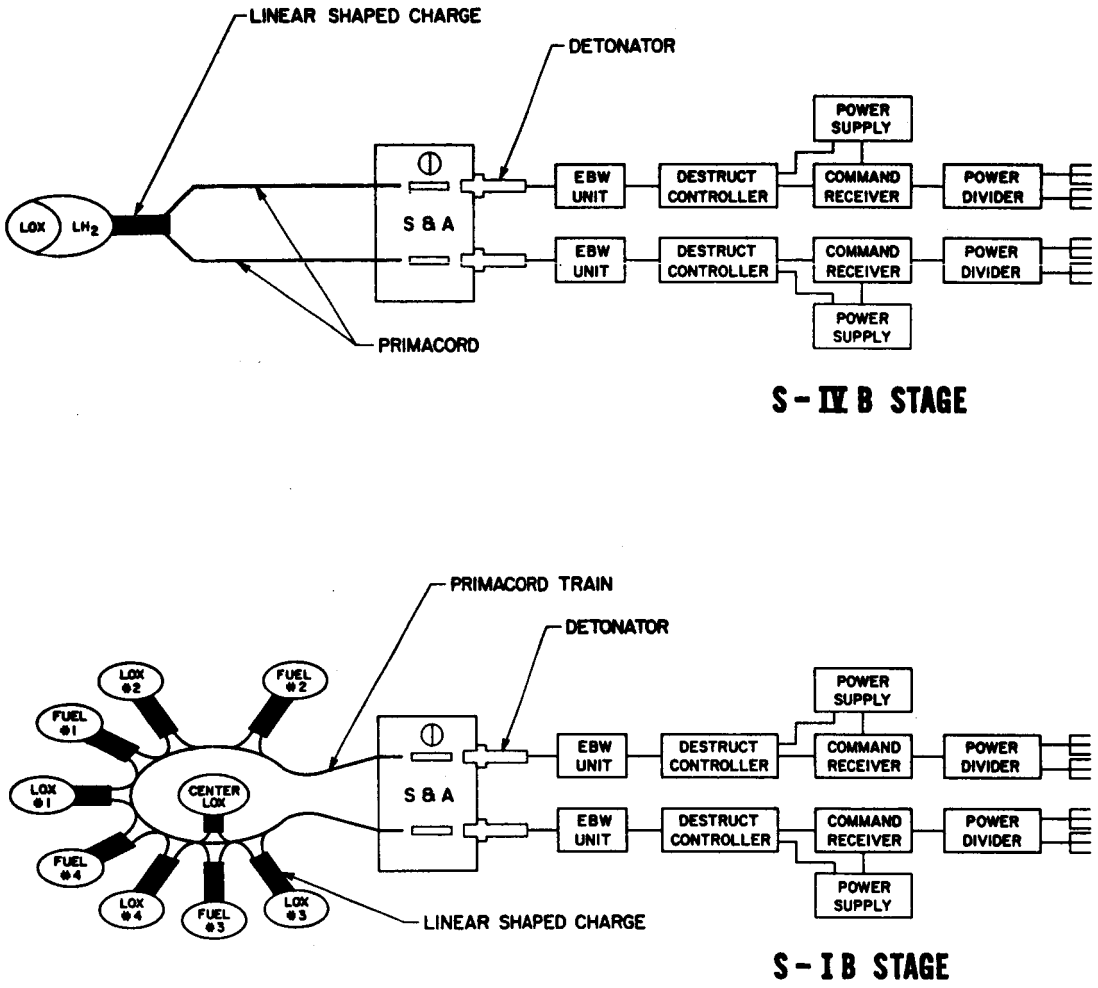

Figure 3-2. Propellant Dispersion System Block Diagram

SECTION IV
FLIGHT SAFETY RESTRICTIONS

4-1 PRECEDENCE

The information contained in this section is disseminated several months before launch and is subject to change at any time. In event of conflict between the Flight Safety Plan and the Apollo Mission Rules published for each launch, the Mission Rules shall be considered the official source for procedures or requirements (the Mission Rules are constantly subject to revision/updating).

4.2 WEATHER RESTRICTIONS

4.2.1 CEILING. A minimum ceiling height is imposed on all launches. The height of the ceiling is determined by the time required for the launch area radars to acquire the vehicle after lift-off. The minimum ceiling for AS-204/LM1 will be 800 feet.

4.2.2 VISIBILITY. A minimum visibility limit is imposed on all launches. The visibility limit is usually determined by the vertical wire skyscreen site selected for the launch. The minimum visibility for AS-204/LM1 will be 4 miles.

4.2.3 WINDS. A wind restriction is usually imposed on the launch if the vehicle remains over Cape Kennedy for any length of time. This restriction prevents pieces of a destricted vehicle from drifting into protected areas. The wind restriction for AS-204/LM1 is a 1 sigma annual wind profile blowing from 65 degrees east of north (Figure 4-1) and applicable to an altitude of 30 kilometers. In the event this profile is violated by prevailing wind conditions during countdown, the Range Safety Division performs a computer-simulated flight, terminating thrust and breaking the vehicle into pieces at each interval, with the prevailing winds acting on them to determine if the pieces can fall outside the impact limit lines.

4.3 IMPACT LIMIT LINES

The impact limit lines to be used for the AS-204/LM1 launch are shown in Figure 4-2. The Cape Kennedy Range Safety Officer (CKRSO) will take range safety action, when necessary, to prevent the vehicle, or pieces thereof, from impacting outside the specified area.

4.4 OPERATIONAL RESTRICTIONS

ANNUAL WIND PROFILE FROM
65 DEGREES FLIGHT AZIMUTH

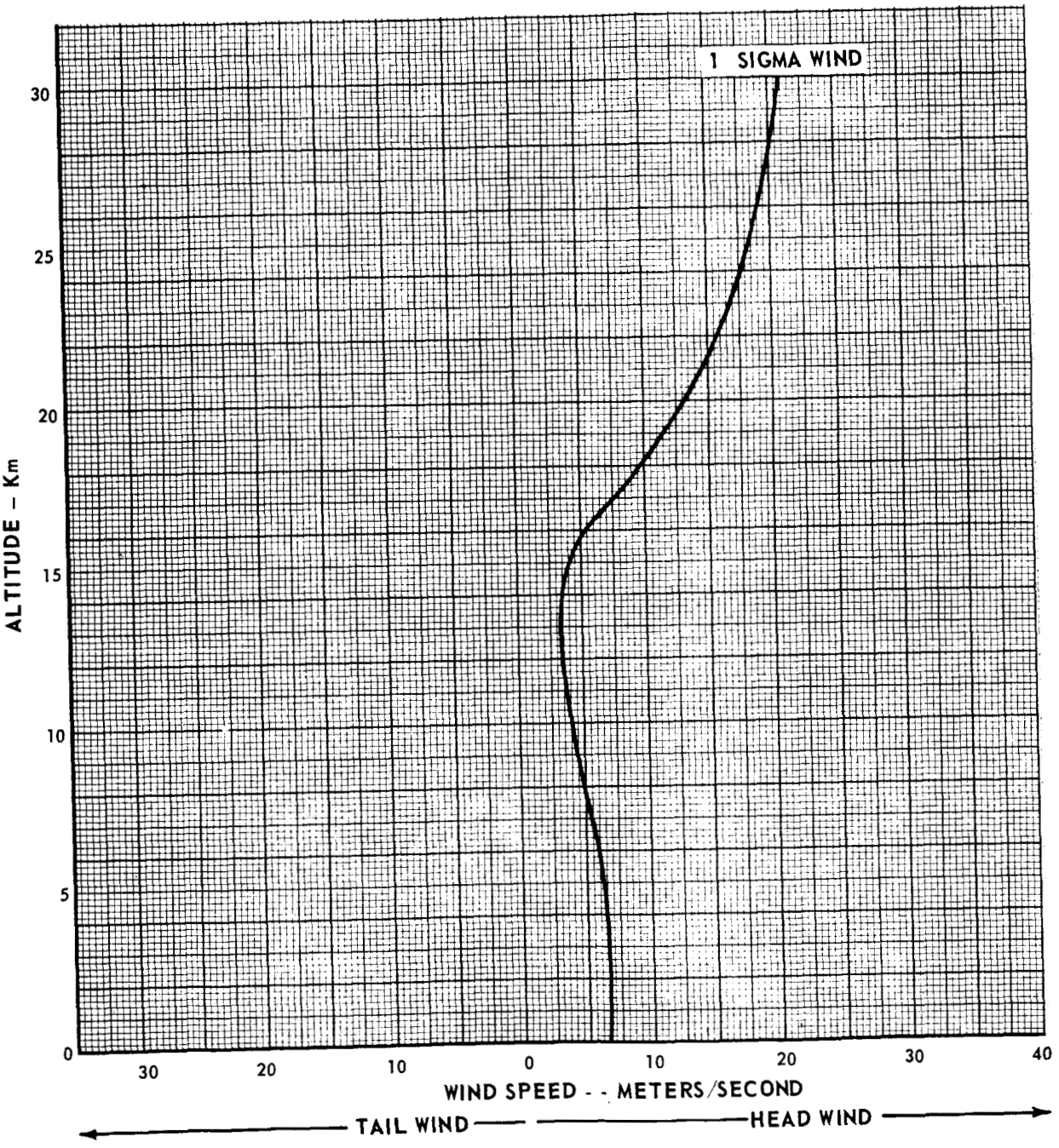

Figure 4-1. 1 Sigma Annual Wind Profile from 65 Degrees Azimuth

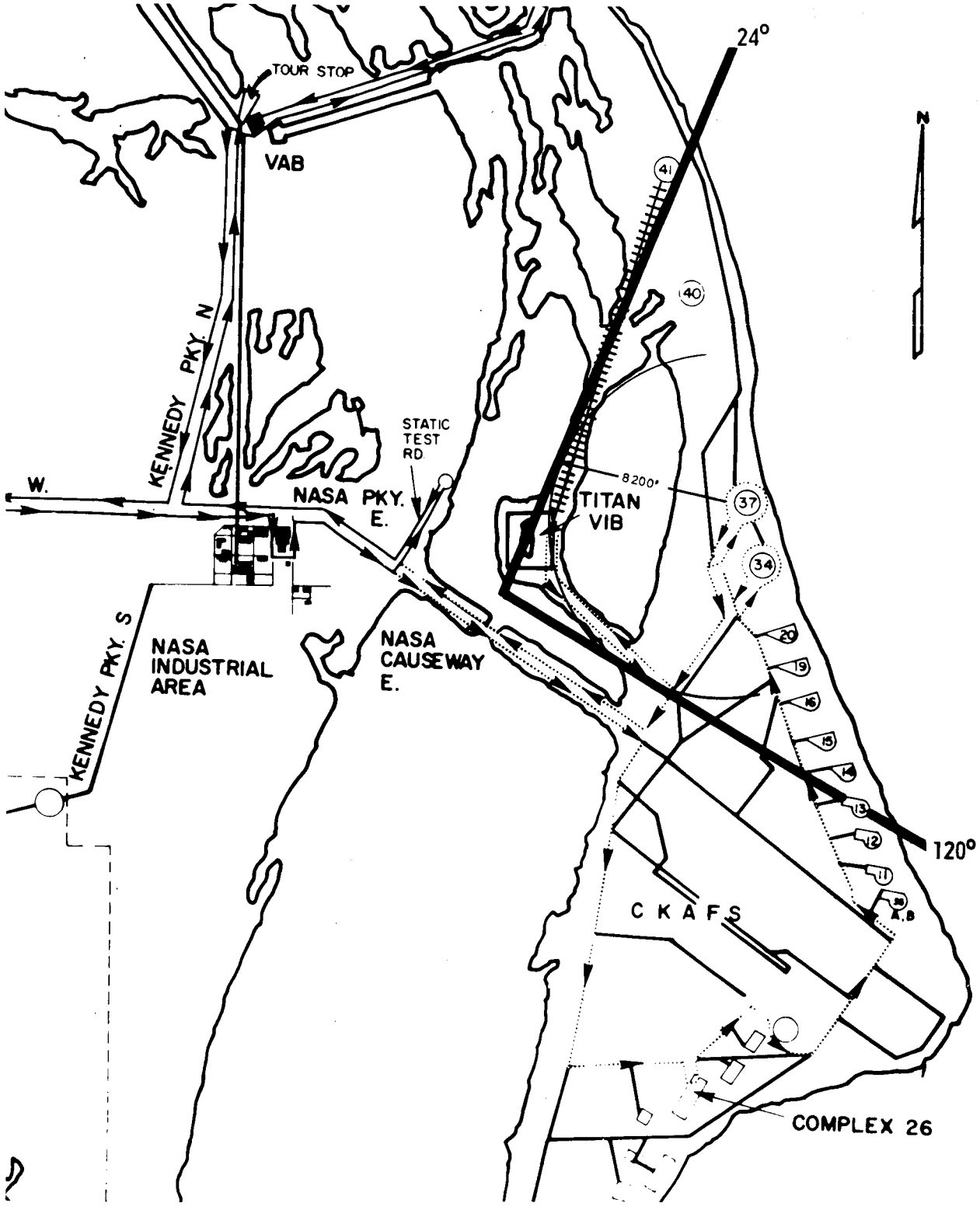

Figure 4-2. AS-204/LM1 Impact Limit Lines

4.4.1 LAUNCH VEHICLE. The following requirements are applicable to the launch vehicle:

a. Two operational range safety command receivers on each stage (S-IB and S-IVB) are mandatory for launch.

b. The instrumentation unit C-band beacon system (both beacons) are mandatory for launch.

4.4.2 SPACECRAFT. None

4.4.3 CREW SAFETY. None

4.4.4 OTHER CONSIDERATIONS. Other agreements and/or restrictions that have bearing on the overall flight safety area are as follows:

a. The NASA Bermuda DRS Command Control system is mandatory for launch.

b. The NASA Bermuda (BDA) FPQ-6, BDA FPS-16, and the Grand Turk TPQ-18 radars (2 of 3 mandatory) will provide raw data to the Cape Kennedy Realtime Computer System (RTCS) for the RSO impact prediction (IP) presentation.

c. An ETR RSO will be required to be at Bermuda for all launch days.

d. Communications between Mission Control Center (MCCH), the CKRSO and the Bermuda RSO (BRSO) are mandatory for launch.

e. Timers in the Cape Kennedy Range Control Center will provide a 2-second delay between ARM and DESTRUCT.

f. Range safety action will not normally require DESTRUCT after S-IB staging. If Manual Fuel Cut-off (MFCO) does not establish an impact point (after S-IB staging), the RSO will verbally request Flight (MCCH) to send ABORT followed by ENGINE STOP OVERRIDE. The RSO may elect to transmit DESTRUCT if the above procedure fails to terminate thrust.

g. The RSO will send MFCO and request ENGINE STOP OVERRIDE of the MCCH whenever range safety action is required. The NASA LM1 Electrical, Environmental, and Communications Systems Engineer (LM1 EECOM) will not reset the ENGINE STOP OVERRIDE command after any range safety action.

h. The BRSO will transmit the SAFING command to the range safety command receivers after normal S-IVB cutoff. He will transmit the SAFING command only after

SECTION V
FLIGHT SAFETY INSTRUMENTATION

5.1 SAFETY DATA SOURCES

The AFETR requires that at least two different, adequate sources of safety data for each phase of powered flight be operational at launch. An "adequate" source is defined as one that can protect the applicable impact limit line without endangering a normal missile. The RSO will ensure that the adequate data source requirement is met and that those requirements designated "critical" are provided before giving a launch clearance. Those items designated "critical" for AS-204/LM1 are:

a. Impact Predictor
b. Bermuda Command Control Transmitter

Instrumentation available during S-IB stage powered flight are:

a. High Resolution Trackers (HRT) 1 & 2
b. KSC TPQ-18 C-Band Radar (19.18)
c. Patrick AFB TPQ-18 C-Band Radar (0.18)
d. Glotrack Station I
e. Program and Flightline Electronic Sky Screen Equipment (ELSSE)
f. Cape FPS-16 C-Band Radar (1.16)
g. GBI TPQ-18 C-Band Radar (3.18)
h. GBI TPQ-16 C-Band Radar (3.16)

Instrumentation available during S-IVB stage powered flight are:

a. KSC TPQ-18 C-Band Radar (19.18)
b. Patrick AFB TPQ-18 C-Band Radar (0.18)
c. GBI FPS-16 C-Band Radar (3.16)
d. GBI TPQ-18 (3.18)
e. Grand Turk TPQ-18 C-Band Radar (7.18)
f. Flightline ELSSE
g. Cape FPS-16 C-Band Radar (1.16)
h. BDA-6
i. BDA-16
j. Glotrack Station I

APPENDIX A
DOCUMENT CATEGORY

APOLLO/SATURN IB
FLIGHT SAFETY PLAN
VEHICLE AS-204/LM1

Category	Brief Description of Related Contents	Emphasis Pri.	Emphasis Sec.	See Page(s)
11. Safety	Plan presents flight safety requirements, restrictions, and instrumentation necessary for each Apollo/Saturn IB launch.	X		1-1

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